PATENT SPECIFICATION

DRAWINGS ATTACHED

1081707

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Date of Application and filing Complete Specification: Sept. 10, 1964.

No. 37033/64.

Application made in Germany (No. B73504 XII/47h) on Sept. 13, 1963.

Complete Specification Published: Aug. 31, 1967.

Index at acceptance: —F2 D(13C2, 13C7A, 13C7B, 13E2, 13G1A, 13G1B, 13G1C, 13J1, 13K1B)

Int. Cl.:—F 16 h

COMPLETE SPECIFICATION

Improvements in Change-speed Gearboxes

We, ROBERT BOSCH GMBH, a German Company of 4, Breitscheidstrasse, Stuttgart-W, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a change-speed gearbox, such as a vehicle gearbox, having a gear-change mechanism coupled to a gear-change member of the gearbox for remotely engaging and changing gear.

For changing the gears of a gearbox, it is already known to provide two separate hydraulic or pneumatic double-acting cylinders arranged at right angles to each other for selecting the plane of movement of the gear-change-member and for engaging the gears respectively, said cylinders effecting the transverse and longitudinal movements respectively of the gear-change member of the gearbox. A straight slide block is secured to the piston rod of each of the pistons of these cylinders so that the two slide blocks cross each other at right angles and the gear-change member passes through the slide blocks at this point of intersection. The various movements of the gear-change member for changing gear are effected by a precisely controlled introduction of a pressure medium into the double-acting cylinders. These known gear-change mechanisms accordingly require many individual valves and pressure medium conduits, in addition to a pressure generator, corresponding to the number of speed gears of the gear box.

According to the present invention a change-speed gearbox has a gear-change member guided in a straight slot in a slide block of a gear-change mechanism, said gear-change member being movable transversely to the direction of said slot by means of the slide block from one gear-change member operating plane to another and being itself movable longitudinally in said slot for engaging the gears and said gear-change mechanism further comprising a crank drive connected to the gear-change member for effecting its longitudinal movement to engage an appropriate gear.

Conveniently the slide block is connected to a cam drive for effecting displacement of the slide block transversely to the direction of said slot.

Preferably the gear-change mechanism comprises a crank drive and a cam drive connected together so that they are actuated by a common motor, for example, an electric motor, if desired by way of a reduction gear.

This embodiment of the present invention has the advantage that only one driving motor is necessary for carrying out the gear-change movements and therefore the control of the gearbox as a whole is simple. In addition, the gearbox of preferred construction in accordance with the present invention offers a further advantage that the driving force of the motor need only be very low, since powerful operating forces occur at the beginning and end of the stroke of the crank drive, that is to say in an area where the drive movement is greatly reduced.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a side view of a gear box with a gear change mechanism constructed in accordance with the present invention;

Fig. 2 is a schematic plan view of the gear change mechanism shown in Fig. 1; and

Fig. 3 is a similar schematic plan view of another embodiment of gear change mechanism for a gear box.

Referring to Figs. 1 and 2 of the drawings, a gear box 11 of a vehicle transmission is flange-mounted on an internal combustion engine 10 (merely indicated) and is provided

with a gear change lever or gear-change member 12. Pivotably connected to the gear-change member 12 is a connecting rod 13, the other end of which is pivotably connected to a crank pin 15 eccentrically mounted on a gear wheel 14.

Another gear wheel 16 meshes with the gear wheel 14 and is rotated to control the gear box 11 by a reversible electric motor 17.

The eccentricity of the crank pin 15 relative to the axis of the gear wheel 14 is such that the radius of the crank corresponds to the operating movement of the pivot point between the connecting rod 13 and the gear-change member 12 for longitudinal movement of the gear-change member 12 from the neutral position into the position of engagement of one of the various gears.

The axis of rotation of the gear wheel 14 serving simultaneously as a crank is perpendicular to the extension of the medial longitudinal axis of the "operating plan" of the gear box 11 which has four forward gears and one reverse gear in an ordinary H arrangement with one side branch, as shown in chain dotted lines in Fig. 2 with the corresponding reference numerals 1 to 4 and R with respect to the gear positions of the gear-change member 12.

In order to select one of the gears 1 to 4 and R the gear-change member 12 is guided in a straight slot of a slide block 20 extending in the longitudinal direction of the "operating plan", the transverse position of said slide block with respect to the "operating plan" of the gearbox being determined by a cam drive. The cam drive comprises a cam disc 21 having three radially stepped segments corresponding to the operating planes of the gear change members 12 in the "operating plan" and a roller follower 23, journalled to one end of a rod 24, and held in contact with the periphery of the cam disc 21 by the tensile force of a spring 22. The rod 24 is guided in a guide 25 and rigidly connected to the slide block 20. The cam disc 21 is rotated by the electric motor 17 by way of gear wheels 26, 27, 28 and 29, said gear wheels being arranged so that a reduction ratio greater than 1:2, in the present embodiment 1:3, exists between the gear wheel 14 of the crank drive and the gear wheel 29 of the cam drive. This embodiment enables a predetermined position of the cam drive or the slide block 20 to correspond positively to each position of the crank drive.

The mode of gear-selection is as follows: For each operating movement of the gear-change member 12 from one gear position to another, the crank or gear wheel 14 is turned from one dead centre position through a half rotation into the other dead centre position by the electric motor 17, which is switched on during this gear-change operation. The direction of rotation of the electric motor 17 determines the selection of the next higher or lower gear, since the cam disc 21 controls the selection movement of the slide block 20 dependently on this direction of rotation of the electric motor. The basic arrangement of the first embodiment is such that the gearbox is stepped up by turning the crank clockwise and stepped down by turning it anti-clockwise.

Fig. 2 shows a change from first to second gear of the gearbox 11. The electric motor 17 drives the gear wheel 14 in the clockwise direction by way of the gear wheel 16. The connecting rod 13 draws the gear-change member 12 in the slide block 20 to the right into the position of second gear. At the same time the cam disc 21 rotates anti-clockwise through 60° so that the roller 23 of the push rod 24 comes from the point 1′ into contact with the point 2′ on the periphery of the cam disc 21 without the slide block 20 being transversely displaced.

When the gearbox 11 is switched from second to third gear, the operating plane of the gear change member 12 in the "operating plan" must be changed, however. This occurs in the centre part of the semi-circular path of the crank in that, during the 60° turn of the cam disc 21, the roller 23 of the push rod 24 is drawn on to a segment of the cam disc 21 with a smaller radius and on the point 3′ so that the slide block 20 with the gear-change member 12 is displaced upwardly (in Fig. 2).

The change from third to fourth gear is effected in the same manner as the change from first to second gear. Changing down is also effected in a similar manner but the direction of rotation of the gear wheel 11 and cam disc 21, the roller 23 of the push rod ing up.

For engaging reverse gear from first gear the same direction of rotation should be initiated as in changing down. The shifting of the operating plane of the gear-change member 12 through the slide block 20 is controlled by the change over from the segment of the cam disc 21 for the first and second gear to another segment having correspondingly larger radius.

The neutral position of the gear box is obtained by a quarter rotation of the crank or gear wheel 14 so that the gear change member stops in the crossing of H-shaped "operating plan".

The change of gear is initiated, in co-operation with a clutch (not shown) by the driver of the vehicle in which the engine 10 is fitted, semi- or fully automatically by switching on the electric motor in one or other direction. In order to switch off the electric motor 17 after a gear-change movement of the gear-change member 12 is executed, electrical circuit components, such as contacts or limit switches are preferably provided, actuated by

the gear-change member 12 in its various gear positions. It is also possible to switch off the electric motor through one or more contacts which are actuated by cams connected to the shaft of the gear wheel 14 or of the cam disc 21.

It may be mentioned that the contacts can also be used to indicate the existing engaged gear.

A further simplified embodiment of gear-change mechanism is shown in Fig. 3. The transverse motion of the slide block 20 for selecting the gears is controlled in this embodiment by a cam disc 30 which is rigidly connected to the crank or gear wheel 14 and has a spiral cam groove 31. One end of a pivotable lever 32 slides in this cam groove 31 whilst the other end is connected to a rod 33 which carries the slide block 20 and is guided in a straight guide 34.

The spiral cam groove 31 of the cam disc 30 is composed of three concentric arcs of different radii and two S-shaped parts connecting these arcs together. The inner arc portion of the cam groove 31 determines the operating plane of the third and fourth gears, the centre arc portion, the operating plane of the first and second gears and the outer arc portion, that of the reverse gear, whilst the intermediate connecting parts control, together with the cam disc 30 the change of operating planes during the rotation of the crank.

Since this cam disc 30 executes a rotation through 180° with each change of gear, similarly to the crank, the two inner arcs of the cam groove extend through an angle of more than 180°, whilst the connecting parts subtend an angle of approximately 30° to 50° and are approximately diametrically opposed to the centre of the arc determining the operating plane for the first and second gear.

Preferably an electric motor with a permanent magnetic field is used for the drive of the gear-change mechanism. An advantage of this is that the movement is rapidly stopped by short circuiting the armature of the electric motor when a predetermined gear-change member position is reached. It should also be pointed out that pneumatically or hydraulically operating motors may be used for driving the gear-change mechanism.

Finally it may also be observed that gear boxes having different "operating plans", for example, having a single or double H form may be operated by suitably changing the construction of the cam drive.

WHAT WE CLAIM IS:—

1. A change speed gearbox having a gear-change member guided in a straight slot in a slide block of a gear-change mechanism, said gear-change member being movable transversely to the direction of said slot by means of the slide block from one gear-change member operating plane to another and being itself movable longitudinally in said slot for engaging the gears, and said gear-change mechanism further comprising a crank drive connected to the gear-change member for effecting its longitudinal movement to engage an appropriate gear.

2. A gearbox as claimed in claim 1 in which the centre of rotation of the crank of the crank drive is perpendicular to the medial longitudinal axis of the "operating plan" of the gearbox which is of H arrangement with a side branch.

3. A gearbox as claimed in claim 1 or 2 in which the eccentricity of the crank pin of the crank drive is equal to the movement of the gear-change member at the point thereon of articulation to the crank drive from the neutral position into a gear-engaged position.

4. A gearbox as claimed in claim 1, 2 or 3 in which the slide block is connected to a cam drive for producing the transverse movement thereof.

5. A gearbox as claimed in claim 4 in which the crank drive and the cam drive are powered from a common source.

6. A gearbox as claimed in claim 4 or 5 in which the crank of the crank drive and a cam disc of the cam drive are mounted on a common driving shaft.

7. A gearbox as claimed in claim 4 or 5 in which the crank of the crank drive and a cam disc of the cam drive are connected together by way of a reduction gear.

8. A gearbox as claimed in claim 4, 5 or 6 in which the cam drive comprises a cam disc having a spiral cam groove therein and a lever which is connected to the slide block and one end of which is guided in said groove.

9. A gearbox as claimed in claim 4, 5 or 7 in which the cam drive comprises a cam disc with a periphery having portions of different radii and a rod connected to the slide block and urged into contact with the periphery of the cam disc by a spring force.

10. A gearbox as claimed in any preceding claim in which the gear-change mechanism includes an electric motor with a permanent magnetic field for its motive power.

11. A gearbox as claimed in any of claims 1 to 10 in which the gear-change mechanism includes limit switches actuated by the gear-change member for switching itself off.

12. A gearbox as claimed in any of claims 1 to 10 in which the gear-change mechanism includes cams, which actuate contacts during the rotation of the crank drive, for switching itself off.

13. A gearbox constructed and adapted for operation substantially as herein described with reference to and as illustrated in Figs. 1 and 2 of the accompanying drawings.

14. A gearbox embodying a gear-change mechanism constructed substantially as herein

described with reference to and as illustrated in Fig. 3 of the accompanying drawings.

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12, Church Street, Liverpool, 1,
Chartered Patent Agents.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1967.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

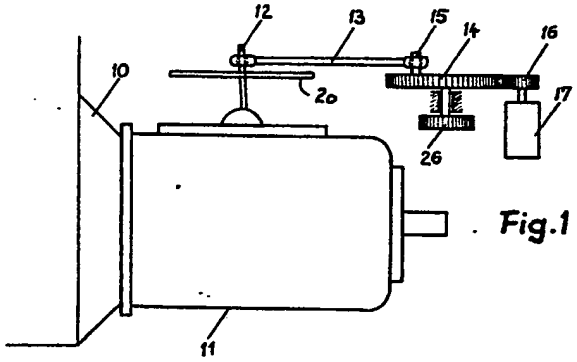

Fig.1

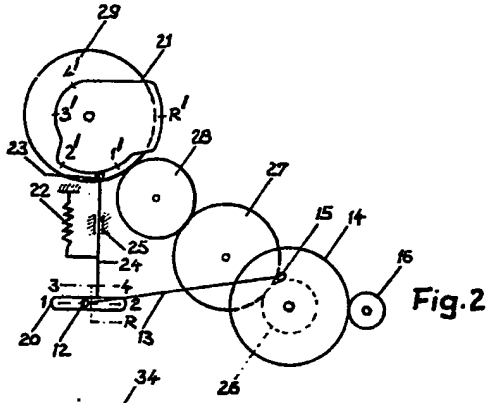

Fig.2

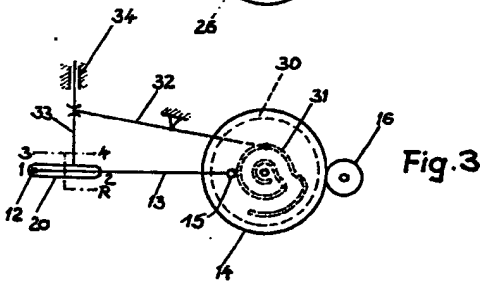

Fig.3